



Center for
Environmental
Information and
Statistics

US Environmental
Protection Agency

Major Findings from the CEIS Review of EPA'S

AEROMETRIC INFORMATION RETRIEVAL SYSTEM - AIR QUALITY SUBSYSTEM (AIRS-AQS) DATABASE



April 2, 1999

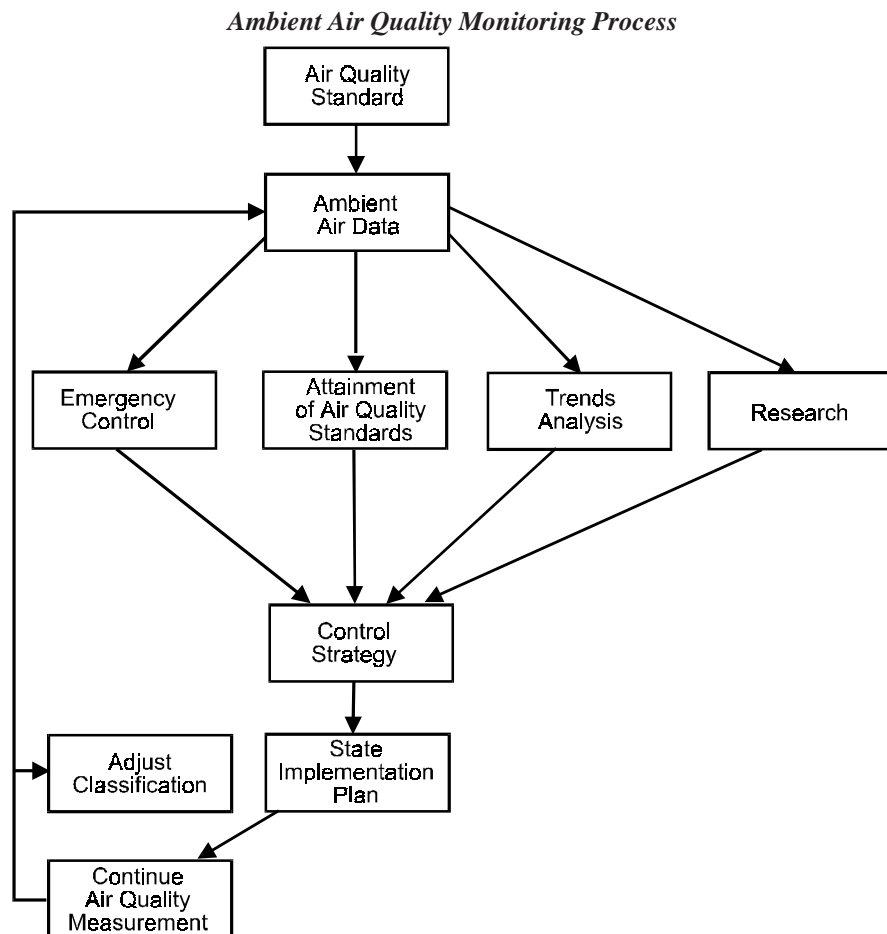
Major Findings from the CEIS Review of EPA's AIRS-AQS Database

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1. INTRODUCTION

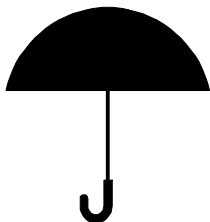
The **Aerometric Information Retrieval System (AIRS)** is a computerized database containing information about certain types of airborne pollutants in the United States. The **Air Quality Subsystem (AQS) of AIRS** contains measurements of ambient concentrations of the criteria pollutants - carbon monoxide, nitrogen dioxide, ozone, lead, particulate matter, and sulfur dioxide, as well as data on air toxics, Volatile Organic Compounds (VOCs), and meteorological data. The **Clean Air Act (CAA)** requires the EPA to set National Ambient Air Quality Standards (NAAQS) for the criteria pollutants. AIRS-AQS allows the EPA to assess the status of the nation's air quality and to identify areas where improvements in air quality are needed. The figure below displays the ambient air quality monitoring process including the uses of the data. The Office of Air Quality Planning and Standards (OAQPS) of EPA is responsible for the maintenance and administration of this database.

AIRS-AQS is one of the major EPA databases that are being reviewed to characterize their overall quality and applicability.



Source: *EPA Quality Assurance Handbook for Air Pollution on Measurement Systems Vol. II: Ambient Air Specific Methods, Draft, March 1997*

2. SUMMARY ANSWERS TO REVIEW QUESTIONS



2.1. What does the database cover?

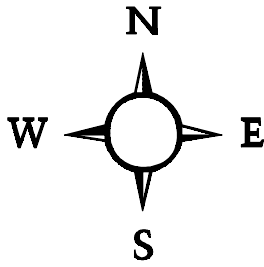
The AIRS-AQS database contains data on ambient concentrations of criteria pollutants including carbon monoxide, nitrogen dioxide, ozone, lead, sulfur dioxide, and particulate matter, as well as data on air toxics, VOC's, and associated meteorological and monitoring site data. The data are collected at thousands of monitoring stations across the United States that are operated by the EPA, other Federal, State, and local agencies. The data include monitoring site descriptions, raw and summary data, and information on precision and accuracy. The sheer volume of these data is an indication of the comprehensiveness of this database. The following table presents the criteria pollutants and the National Ambient Air Quality Standards for each of them.

Pollutant	Standard Value	Standard Type*
Carbon Monoxide (CO)		
8-hour Average	9 ppm	10 mg/m ³ Primary
1-hour Average	35 ppm	40 mg/m ³ Primary
Nitrogen Dioxide (NO ₂)		
Annual Arithmetic Mean	0.053 ppm	100 µg/m ³ Primary & Secondary
Ozone (O ₃)		
1-hour Average*	0.12 ppm	235 µg/m ³ Primary & Secondary
8-hour Average	0.08 ppm	157 µg/m ³ Primary & Secondary
Lead (Pb)		
Quarterly Average		1.5 µg/m ³ Primary & Secondary
Particulates < 10 micrometers (PM-10)		
Annual Arithmetic Mean		50 µg/m ³ Primary & Secondary
24-hour Average		150 µg/m ³ Primary & Secondary
Particulates < 2.5 micrometers (PM-2.5)		
Annual Arithmetic Mean		15 µg/m ³ Primary & Secondary
24-hour Average		65 µg/m ³ Primary & Secondary
Sulfur Dioxide (SO ₂)		
Annual Arithmetic Mean	0.03 ppm	80 µg/m ³ Primary
24-hour Average	0.14 ppm	365 µg/m ³ Primary
3-hour Average	0.50 ppm	1,300 µg/m ³ Secondary

* Primary: **Health**
Secondary: **Welfare**

* The ozone 1-hour standard applies only to areas that were designated nonattainment when the ozone 8-hour standard was adopted in July 1997.

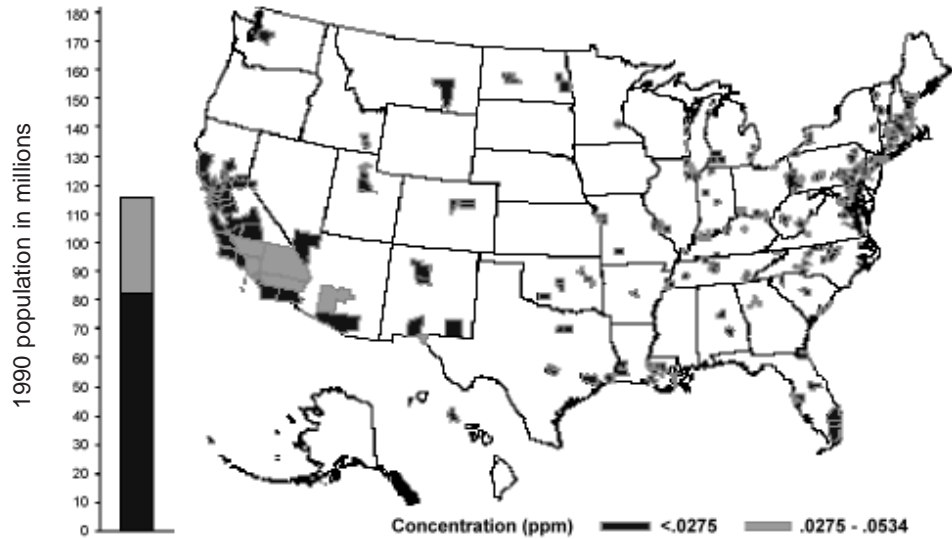
The AIRS-AQS also contains limited data on air toxics. These data are available for almost 60 ozone precursors for twenty-one ozone nonattainment areas (i.e., areas classified as serious, severe, or extreme in not meeting Federal standards for air quality.) Additional limited data are available on air toxics based on voluntary submission.



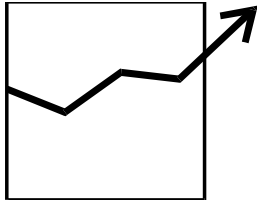
2.2. Can the database be used for spatial analysis?

Yes, since the data can be accessed at the national, Regional, State, county, and city level, and also by latitude and longitude. (See an example of county-level analysis in the chart below.)

Highest NO₂ annual mean concentration by county, 1997



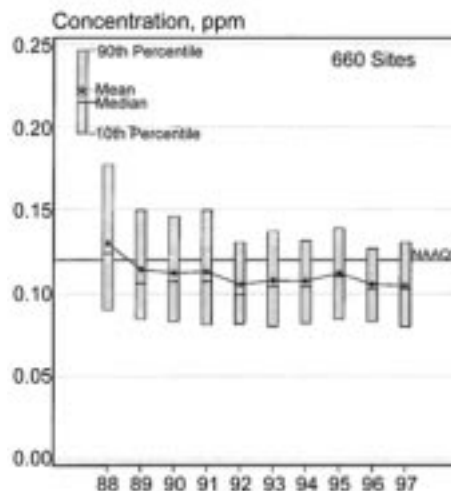
Source: *National Air Quality and Emissions Trends Report, 1997, OAQPS, EPA, December 1998*



2.3. Can the database be used for temporal analysis?

Yes, raw data are archived as one-hour averages of continuously sampled pollutant concentrations or as 24-hour averages derived from discrete or intermittent samples. Summary data are also available on a quarterly and annual basis. However, there are some limitations due to changes in the monitoring network over the years. The volume of data through time is highly variable from State to State for years prior to 1979 when monitoring siting and quality assurance procedures were made uniform.

*Trend in annual second-highest daily maximum
1-hour O₃ concentrations, 1988-1997*

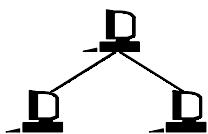


Source: *National Air Quality and Emissions Trends Report, 1997, OAQPS, EPA, December 1998*



2.4. How consistent are the variables over space and time?

As far as internal consistency, data on the same criteria pollutants are collected at a monitoring site over time, and there is consistency in how the variables are measured.



2.5. Can data from AIRS-AQS be linked with information from other databases?

AIRS-AQS includes latitude/longitude data, parameter codes from which Chemical Abstract Service (CAS) numbers to identify chemicals can be obtained, and Federal Information Processing Standards (FIPS) codes for States and counties, to facilitate linkage with other databases.



2.6. How accurate are the data in AIRS-AQS?

Five percent of the data have been audited and the overall error rate for gross errors (misplaced decimal point, corrupted data, or problematic site information) is less than 0.01%.



2.7. What are the limitations of AIRS-AQS?

AIRS-AQS has certain limitations. The focus is primarily on criteria pollutants, including carbon monoxide, nitrogen dioxide, ozone, lead, sulfur dioxide, and particulate matter. In performing comparative spatial analysis, it should be noted that the number of monitors varies from one area to another. While data are available for years as early as 1957, consistent data are available only since 1979. Pre-1979 data were not collected using uniform monitoring siting or quality assurance procedures.



2.8. How can I get information on AIRS-AQS?

AIRS-AQS data are provided in a number of formats including (1) electronically by way of either an account on EPA's mainframe or via AIRS Web, (2) AIRS Executive which is a PC based program, and (3) hard copy reports.

There is a report available based on data from AIRS-AQS. It is entitled "National Air Quality and Emission Trends Reports" (Document number EPA 454R97013) and can be obtained by contacting the EPA's Public Information Center at (202) 260-7751.

Accessing AIRS Data Online

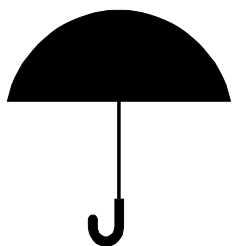
Data from Online Providers/Internet Site	For More Information
US EPA Internet Server - Access a variety of general information about AIRS http://www.epa.gov/airs/	Telephone (800) 334-2405
US EPA Internet Server - Access to air pollution data for the entire US. http://www.epa.gov/airsweb/	Telephone (800) 334-2405 hamlin.michael@epamail.epa.gov



2.9. Is there documentation on AIRS-AQS?

Documentation on AIRS-AQS is available from the Office of Air Quality Planning and Standards, EPA.

3. DETAILED ANSWERS TO REVIEW QUESTIONS



3.1. What does the database cover?

Who Must Report?

The Clean Air Act requires the EPA to set National Ambient Air Quality Standards (NAAQS) for the six criteria pollutants: carbon monoxide, nitrogen dioxide, ozone, lead, sulfur dioxide, and particulate matter. The Act also requires every State to establish a network of air monitoring stations for these pollutants, using criteria set by the Office of Air Quality Planning and Standards (OAQPS) for their location and operation. The monitoring stations in this network are called the State and Local Air Monitoring Stations (SLAMS). States must provide an annual summary of monitoring results for each State and local air monitoring station to OAQPS and detailed results must be available upon request. Organizations reporting SLAMS data for inclusion in AIRS-AQS may include a State, a subordinate organization within a State, or another organization that is responsible for a set of stations that monitor the same pollutant and for which precision or accuracy assessments can be pooled. States must define one or more reporting organizations for each pollutant such that each monitoring station in the State SLAMS network is included in one and only one reporting organization. Reporting organizations are responsible for collecting and reporting quality assurance information. OAQPS designated some of the SLAMS monitoring stations as monitors for the National Air Monitoring Stations (NAMS). NAMS monitors submit detailed quarterly and annual monitoring results to OAQPS. Currently, about 4,000 NAMS and SLAMS monitoring sites report air quality data for one or more of the six criteria pollutants.

An additional network, the Photochemical Assessment Monitoring Stations (PAMS), collects data on ozone, nitrogen oxides, and a target list of nearly 60 volatile organic compounds that include ten hazardous air pollutants. The PAMS data are available from 1994 for 21 ozone nonattainment areas classified as serious, severe, or extreme. Ambient data on any of the 188 air toxics (listed in the Clean Air Act Amendments of 1990) or any other air pollutant may also be submitted on a voluntary basis by any monitoring body for inclusion in the database.

How are data reported?

A reporting organization submits data for the sites that it is responsible for. The organization uses EPA's AIRS-AQS software to provide the data to OAQPS. This software is used to enter the data into a "screening file," check the validity of the transactions, and correct any errors found. After validation, the reporting organization informs the AIRS database administrator who uses the validated screening file to update the AIRS-AQS database. The data is loaded into the database within 90 days after the end of each quarter.

Data Elements

The raw data submitted by the reporting organizations are either 1-hour averages of continuously-sampled pollutant concentrations or 24-hour averages derived from discrete or intermittent samples. The following are the key

variables, the definitions of which are included in the Data Elements Dictionary, a part of the documentation on AIRS-AQS discussed later.

Identification variables

Site information: support agency, street address, date site established, date site terminated, HQ evaluation date, Regional evaluation date, meteorological site identification, distance site, direction site, State or local identification, sequence number, street name, road type, traffic flow, year of traffic flow, direction to street, site location type, open path number, direction to transmitter, beam length, transmitter height, minimum beam height, maximum beam length, land use under path.

Monitor Information: Monitor type, date type effective, analyzing lab, collection lab, reporting organization, reporting organization effective date, date sampling began, date sampling ended, audit date, project class, action type, action type reason, dominant source, measurement scale, monitor type objective, nonattainment area, urban area represented, Photochemical Assessment Monitoring Stations required sampling frequency, monitor open path number, monitor street 1, distance from road 1, monitor street 2, distance from road 2, monitor street 3, distance from road 3, reference method used, reference method used date, site criteria met, date site criteria met, QA Plan, QA effective date, probe location code, probe height, horizontal distance, vertical distance, unrestricted air flow, obstruction #1, type obstruction, direction from monitor, distance from inlet, height of obstruction, obstruction #2, type obstruction, direction from monitor, distance from inlet, height of obstruction, obstruction #3, type obstruction, direction from monitor, distance from inlet, height of obstruction, monitoring area, worst site, surrogate flag, number of samples required for given month, required sampling frequency, Required Sampling Frequency effective date, short term sampling schedule, short term completion date, first-exceedance correction, monitor comments

Response Variables (these vary from pollutant to pollutant)

interval, units, decimal position, weighted arithmetic mean, summary criteria, sampling data, exceedance occurrence, exceedance value, exceedance date, observation 1 hour, observation 24 hour, 24 hour first max, 24 hour first max date, 24 hour second max/date, 3 hour first max/time, 3 hour second max/time, 3 hour accedence, 24 hour exceedance, arithmetic mean, summary criteria flag, observation 1 hour, 1 hour [1st max, time, 2nd max, time], 8 hour [1st max, time, 2nd max, time], 1 hour exceedance, 8 hour exceedance, method, number of samples, frequency, decimal position, sample value, validity flag, sampling frequency, period code, number of samples, composite type, parameter, parameter occurrence code, monitor ID, interval, units, method, begin year, begin month, end year, end month, min det value, reason code.

Temporal variables

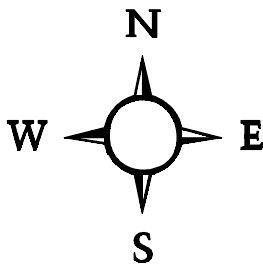
year, month, day, start hour

Spatial variables

city, air quality control Region, metropolitan statistical area, air basin, elevation mean sea level, compass sector, distance city, location setting, land use, difference Greenwich mean time, metropolitan statistical area represented, consolidated metropolitan statistical area represented, universal transverse Mercator zone, universal transverse Mercator easting, universal transverse Mercator northing, latitude, longitude.

QA/QC Information

monitor id, interval, units, method, year, month, day, year represented, quarter represented, type audit, local primary standard, audit classification, decimal position, actual level (1 and 2), indicated level (1 and 2), sequence number, actual designated, indicated collocated mon (1-5), audit type, actual level (1-5), indicated level (1-5), zero span.



3.2. Can the database be used for spatial analysis?

AIRS-AQS contains data that can be accessed at the national, Regional, State, county, and city level. However, the distribution of monitoring stations and the pollutants monitored vary from State to State with some counties and cities having no monitoring stations. The spatial variables in the database are:

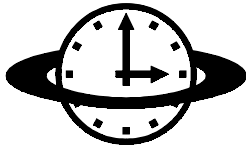
- Metropolitan area
- County
- EPA Region
- State
- State and county FIPS code
- Latitude and longitude



3.3. Can the database be used for temporal analysis?

The national, State, and local agencies that operate the monitors supply AIRS-AQS with individual values of pollutant concentrations and meteorological conditions measured at the monitoring sites. Most of these raw data values are archived as either 1-hour averages of continuously-sampled pollutant concentrations or as 24-hour averages derived from discrete or intermittent samples. Summary data derived from the raw data include annual and quarterly maximum, minimum, and average raw data values; total number of values reported; number of values exceeding national ambient air quality standards; and many other basic summary statistics. Trends analysis is possible at many levels of detail as the data are available on a consistent basis over time for every year beginning with 1979.

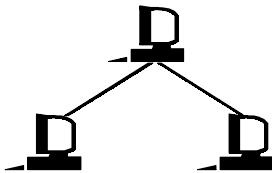
The AIRS-AQS replaced SAROAD (Storage and Retrieval of Aerometric Data) data system which was implemented after Congress passed the Clean Air Act. SAROAD contained ambient air quality and meteorological data, including some data from the National Air Sampling Network. This network was established in 1957 as the first nationwide air monitoring system. Because data were absorbed into each succeeding system, some data in the Air Quality Subsystem date back to 1957. However, considerable caution should be exercised when conducting trends analysis with the older data since there is a lack of consistency in the data collected prior to 1979.



3.4. How consistent are the variables over space and time?

The data collection varies with the pollutant for which data are collected. There is an institutionalized data collection design and process with strict QA/QC controls. EPA has issued a number of guidance documents to ensure the data collection organizations are using consistent methods for each pollutant. In addition, there are yearly conferences on data collection held to promote national consistency.

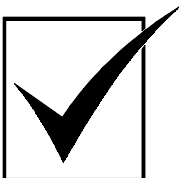
Overall, 75% to 80% of the required data are reported to the system in a timely manner. There is substantial variability from State to State on the number of pollutants reported. All sites and monitors are under the same rules for the reporting of geographic coordinates and the accuracy of those coordinates. The volume of data over time is highly variable from State to State especially for older data (pre-1979). Since 1979, however, there has been consistency in the reporting of criteria pollutants to the system from all States.



3.5. Can data from AIRS-AQS be linked with information from other databases?

AIRS-AQS may be linked with other databases; however, the determination of suitability should be made on a case-by-case basis. The AIRS-AQS data can be “linked” (merged or queried) as shown by some of the variables listed below:

- Latitude and longitude
- Parameter codes from which CAS numbers for chemicals can be obtained
- FIPS codes for States and counties



3.6. How accurate are the data in AIRS-AQS?

Documented QA/QC procedures in conformance with EPA QA/QC guidance and requirements exist, are applied as specified, and 5% of the data generated have been audited by OAQPS. The overall error rate for gross errors is less than 0.01%.



3.7. What are the limitations of AIRS-AQS?

The AIRS-AQS database contains data on ambient concentrations of air pollutants and associated meteorological data that is used by EPA to assess the nation's air quality and to prepare reports to Congress as mandated by the Clean Air Act. EPA also uses the data to identify nonattainment areas relative to the NAAQS set for the criteria pollutants. In using the data from AIRS-AQS, the following limitations apply:

- AIRS-AQS focuses primarily on the six criteria pollutants and has limited data on air toxics. It is, therefore, not an indicator of overall air quality. AIRS-AQS does contain ambient data for some toxic compounds, though the number of pollutants and spatial and temporal coverage of these data are limited.
- The number of monitors varies from one geographical region to another. For instance, when comparing two counties, it may be found that the number of monitors in one county is substantially greater than in the other. Additionally, the data for a geographical unit, such as a county, may not be a true representation of the air quality of the entire unit if there are very few monitors over a large geographical area.
- While the AIRS-AQS database has data from 1957, consistent data for trends analysis are available only beginning with 1979.
- The air toxics data cannot be used to conduct a national level analysis since it is not comprehensive for all regions. However, some States and localities (for example, California) have sufficient data to allow regional and temporal analyses for those regions.



3.8. How can I get information on AIRS-AQS?

The AIRS-AQS database resides on EPA's internal mainframe computer system and may only be accessed with an account on the system.

General information on AIRS-AQS may also be obtained from:

AIRS Help line (MD-34C)
Information Transfer and Program Integration Division
Research Triangle Park, NC 27711
Phone: (800) 367-1044
Fax: (919) 541-0028

Electronic Media

AIRS-AQS can be accessed by obtaining an account at the EPA National Computer Center and paying the applicable computer usage charges. Information about obtaining a computer account is available from:

EPA National Computer Center
Phone: (800) 334-2405 (toll free) or (919) 541-7862

Online services

EPA provides summary information from the AIRS-AQS database on the Internet at the following web sites:

AIRS Homepage provides general information including downloading of AIRS Executive, a PC based program which provides direct access to summary data.

<http://www.epa.gov/airs>

AIRS Web provides more specific information about AIRS and subsets of the AIRS-AQS data.

<http://www.epa.gov/airsweb>

Printed Media

Annual air quality trends reports are available from 1973, and may be obtained from the following sources:

National Technical Information Center
Phone: (703) 487-4650
Fax: (703) 321-8547

Public Information Center
EPA
Phone: (202) 260-7751
Fax: (202) 260-6257



3.9. Is there documentation on AIRS-AQS?

Statutory Authority

- US Code Title 42 The Public Health and Welfare, Chapter 85 Air Pollution Prevention and Control
- Clean Air Act Amendments of 1990, US Code, volume 42, section 7403(c)(2), 1990 Code of Federal Regulations 40; 58

Key Information

- Aerometric Information Retrieval System (AIRS), US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC

Internal Consistency

- Ambient Air Quality Surveillance, 44 CFR 27558, May 10, 1979
- Ambient Air Quality Surveillance, 51 CFR 9597, March 19, 1986
- Developing Data Quality Objectives and a Quality System for Ozone
- Developing A Quality System for PM 2.5
- AIRS Users Guide, Volume AQ1: AQS Data Dictionary, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC
- AIRS Users Guide, Volume AQ2: Air Quality Data Coding, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC
- AIRS Users Guide, Volume AQ3: Air Quality Data Storage, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC

Information dissemination

- National Air Quality and Emissions Trends Report (1997), EPA-454/R-98-016, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, December 1998. (available on the internet at <http://www.epa.gov/oar/aqtrnd97>)